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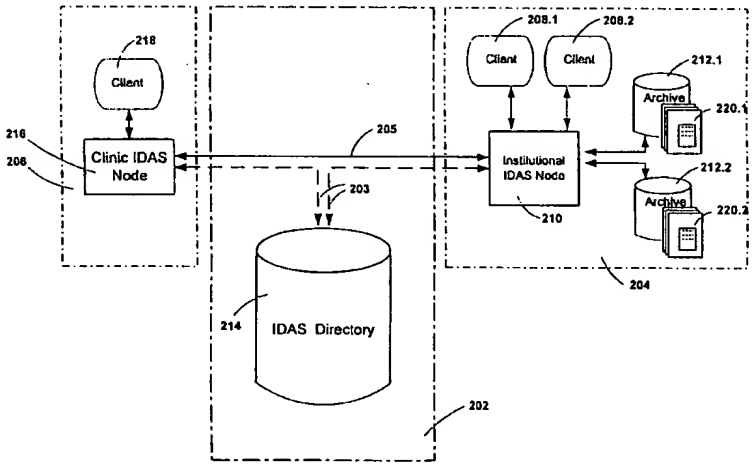

(57) Abstract: The current invention presents a system for the transfer of medical images that conform to a common medical image storage and retrieval protocol between computers that are located across a wide area network. In accordance with one aspect of the invention the system comprises; one or more image storage servers, each image storage server providing one or more medical images that conform to a common image storage and retrieval protocol, each image storage server being an element of a local area network and each image storage server being connectable to a wide area network, a list server for providing a list of one or more medical images available from the image storage servers and contact information for each local area network, the list server being connectable to the wide area network, and one or more client computers being able to request one or more medical images for transfer across the wide area network using the common image storage and retrieval protocol, each client computer being an element of a local area network and each client computer being connectable to a wide area network.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

System and Method for Transfer of Medical Images

Field of the Invention

The invention relates generally to medical images, and more particularly to an Internet based system for the transfer of medical images.

Background of the Invention

There is a growing need for universal availability of medical images for radiologists, physicians and other interested parties who would benefit from access to medical images from different medical institutions that may be at different geographical locations.

Computer systems used for the storage and retrieval of digital medical images are generally known as Picture Archiving and Communication (PAC) systems. These systems generally comprise: extensive digital storage capabilities, a processor for indexing medical images and workstations, attached through a Local Area Network (LAN) for medical image retrieval and viewing. PAC systems are generally designed as client-server systems with the workstation containing software to interact with the PAC system when acting as a client and software to act as an medical image server such that the workstation can obtain and display medical images.

There have been efforts to standardize the above systems such that a client can interact with multiple servers which each act as a source of medical images. One approach considers the standardization of messages and interfaces. The Digital Imaging and Communications in Medicine (DICOM) Standard (protocol) was introduced in 1985 by the American College of Radiology /The National Electrical Manufacturers Association (ACR- NEMA) and is outlined in; ARC-NEMA Standards Publication No. 300. The DICOM Standard is meant to provide a degree of universality to the formatting of medical images thereby facilitating communication of digital medical image information between medical devices, regardless of the manufacturer of the equipment on which they were collected. The standard has been adopted by most modality and PACs vendors allowing it to become the typical method for exchanging medical-imaging data between two computer systems.

DICOM-compliant medical image archives are ubiquitous at hospitals throughout the world. A server that comprises medical images that conform to the DICOM protocol are generally referred to as DICOM Nodes. DICOM Nodes interface to modalities, viewing stations and other DICOM-compliant equipment that come from different manufacturers. The retrieval of medical images stored according to the DICOM Standard requires a DICOM transfer request be placed with the DICOM Node containing the medical image. The above attributes form what will be referred to as a standard DICOM system. The strengths and limitations of a standard DICOM system will be known to those of skill in the art.

While the DICOM Standard has been very successful at facilitating interoperability and information exchange at the hospital-level LAN it does not address issues that arise when access to medical image data is needed on a regional, national or global scale, such as would be required in a Wide Area Network (WAN).

A standard DICOM system does not provide automatic locating of DICOM medical image archives in a dynamic environment. A DICOM Node's contact information, i.e., IP address and port number, needs to be added manually to the contact lists of all other DICOM Nodes that need to communicate with it. Therefore, for example, an archive within which a plurality of medical images are stored requires the contact information for all viewers to whom it will provide data. It will be apparent to those of skill in the art that such a system is not feasible in a WAN environment.

Further with the use of a WAN one has the ability to access a plurality of institutions and servers contained therein that contain medical images. One would like to efficiently determine which server or servers of the above plurality of servers contains the requested medical image without the need to send a separate query to every server from which medical images may be retrieved. This process which is currently required for a standard DICOM system does not efficiently scale up to the WAN level.

The Internet and its suite of communications protocols has become a widely used WAN. That essentially standardizes the protocols for the distribution of information over a wide area. While sometimes being used for the purposes of sharing information locally (at the institutional LAN level) the Internet's main strength is the ability to distribute and share information globally (at the world WAN

level). The built-in scalability of the Internet as a distribution channel that naturally facilitates universal accessibility of information ("anywhere at anytime") is a strength of the Internet that many other electronic information distribution solutions including standard DICOM lack. Therefore it is apparent that a system for the distribution of information over a wide area could beneficially access the capabilities provided by the Internet.

There are a variety of circumstances in which access to medical images from outside the institution in which they are stored is beneficial. The circumstances are associated with the requirements of various health care professionals including; radiologists, physicians and researchers. It will be apparent to one skilled in the art that this list is not meant to be exhaustive. Rather it is representative of the needs of various professionals in the medical community. Some exemplary current and near-term relevant clinical needs will now be discussed.

Radiologists often use and sometimes rely upon prior imaging studies of a patient to best interpret the imaging information associated with the current study. These prior studies may occasionally reside in DICOM-compliant archives in other institutions. In the case of standard DICOM, radiologists who want to access medical images from multiple imaging facilities have to have each facility install and allow them to use a "virtual private network" to access that facilities DICOM medical image archives. The radiologist then configures their reading and viewing station to access the DICOM medical image archives in all the facilities. Making the above system work reliably and securely involves technical challenges and may often not be a practical solution. While virtually all current DICOM medical image archives offer some kind of Internet-based access, such access is either unsuitable for effective interpretation, or it requires using a proprietary viewer, which may be different for each institution serviced by the radiologist. Thus the Internet based capabilities are far from standardized and do not access the full capabilities of the Internet.

Physicians constitute a second group of professionals that often require ongoing access to a patient's medical images. This access may span weeks or months after the imaging study and often from a number of different physical locations and institutions. Remote access to the imaging information may also be required for tele-consultation and e-conferencing between physicians. Such conferencing would greatly benefit from standard DICOM information and facilitate the 3D post-

processing of DICOM medical images at the physician workstation. Non-DICOM methods that allow referring physicians access to medical images across the Internet, e.g., by converting them to GIF or JPEG medical images, do not provide the DICOM information required for 3D post-processing.

Medical researchers would also benefit from wide access to medical images and the broad range of pathological information there within. Such access may be freely permitted if all patient identification has been removed. Insurance adjusters may also benefit from access to medical images related to a given claim in order to assess its validity.

Finally, with the growing "patient empowerment" trend, patients will often request access to their own imaging information. Since patients will almost always be remote from the DICOM Nodes that contain the medical images Internet accessibility would be beneficial. Further, patients may wish to tele-consult with experts across the Internet. This may often require that the experts will have access to the patient's medical images before rendering an opinion. Implementation of a life-long patient record requires ubiquitous access to medical images over long periods of time.

Moreover, a standard DICOM system is not suited for the distribution of imaging information over the Internet. Systems that have been developed providing this capability are often cumbersome and do not fully access the capabilities provided by the Internet. On the other hand, medical image distribution solutions developed for the Internet are based on the use of proprietary technologies and thus are only suited for users who choose to work with one vendor. They do not leverage the capabilities and standardization of DICOM; the leading medical imaging communication standard.

Therefore, there is a need for a system for the transferring of medical images that follow the DICOM Standard beyond local area networks within institutions, for which the DICOM Standard is well suited. The system would preferably use the Internet and its suite of communications protocols. The system would also implement security measures allowing the secure distribution of medical information across the Internet to authorized users.

Summary of the Invention

It is an object of the invention to provide a novel system and method for the

transfer of medical images across a wide area network that obviates or mitigates at least one of the disadvantages of the prior art.

In accordance with one aspect of the invention a system for transferring one or more medical images between two or more local area networks across a wide area network is presented. The system comprises; one or more image storage servers a list server and one or more client computers.

In accordance with another aspect of the invention a system for transferring medical images over a wide area network is presented. The system comprises; two or more local area networks, each local area network comprising a collection of one or more medical images, the on or more medical images being comprised by one or more image storage servers and the one or more medical images conform to a common image storage and retrieval protocol, one or more clients being able to request one or more medical images and a local area network server being connectable to the wide area network, and a list server for providing a list of one or more medical images available from the image storage servers and contact information for the local area network servers, the list server being connectable to the wide area network.

In accordance with another aspect of the invention a local area network that forms an element of a system for transferring one or more medical images over a wide area network is presented. The local area network comprises; one or more computers acting as clients within the local area network, one or more image storage servers comprising the one or more medical images that conform to a common image storage and retrieval protocol, and a local area network server, the local area network server providing an interface between the local area network and a wide area network to which the local area network server is connected to and in communications with, the local area network server maintaining a list of image storage servers within the local area network containing medical images.

In accordance with another aspect of the invention a list server that is an element of a system for transferring one or more medical images across a wide area network I presented. The list server comprises; a list of one or more medical images comprised by one or more image storage servers of local area networks that are elements of a system for transferring medical images, a directory comprising contact information for multiple local area network servers of local area networks that are elements of a system for transferring medical images, and a connecting unit for

connecting to the wide area network for communicating with the two or more local area network servers.

In accordance with another aspect of the invention a method of requesting one or more medical images that conform to a common image storage and retrieval protocol within a system for transferring one or more medical images across a wide area network is presented. The method comprising the steps of; receiving a query by a local area network server from a requesting client who is an element of the same local area network as the local area network server, the query being in accordance with a common image storage and retrieval protocol, analyzing information provided in the query by the local area network server of the local area network of the requesting client, contacting a list server by the local area network server of the local area network of the requesting client, receiving from the list server a list of one or more medical images comprised by the system for transferring medical images which are available to and are of interest to the requesting client, and returning the list of available medical images to the requesting client.

In accordance with another aspect of the invention a method of transferring one or more medical images that conform to a common image storage and retrieval protocol from a first local area network that comprises one or more medical images and a local area network server to a second local area network that comprises one or more clients and a local area network server across a wide area network is presented. The method of transferring one or more medical images comprises the steps of; receiving a selection of a one or more medical images which conforms to the common image storage and retrieval protocol, contacting a list server of the wide area network by the local area network server of the second local area network, providing contact and security information by the list server of the wide area network to the local area network server of the second local area network, contacting the local area network server of the first local area network by the local area network server of the second local area network using the contact and security information, retrieving the requested one or more medical images by the local area network server of the first local area network, and forwarding of the one or more medical images retrieved from the first local area network to the second local area network via the external network.

In accordance with another aspect of the invention a method by which a list server facilitates the transfer of one or more medical images across a wide area

network is presented. The method comprising the steps of; receiving a query from a local area network server of a client requesting one or more medical images, forming a list of one or more medical images comprised by the system for transferring medical images, returning the list of one or more medical images to the local area network server of the local area network that comprises the client requesting the one or more medical images, and providing contact and security information to the local area network server of the local area network that comprises the client requesting one or more medical images.

Brief Description of the Drawings

The invention will be described with reference to the accompanying drawings, wherein:

Figure 1 is a schematic diagram illustrating the networks of the medical image transfer system of the current invention;

Figure 2 is a schematic diagram that illustrates details of the networks presented in Figure 1;

Figure 3 is a flow chart of the query process performed during a request for the transfer of medical images; and

Figure 4 is a flow chart of the medical image retrieval process performed during the transfer of medical images.

Detailed Description Embodiments of the Invention

The currently preferred embodiment presents a system and architecture for transferring medical images that conform to the DICOM protocol from one local area network to another, remote local area network. In the currently preferred embodiment the transfer between local area networks occurs across the Internet via a third party entity that will be referred to as the Internet DICOM Access Service or IDAS. IDAS provides clients access to medical images contained in servers that are elements of the medical image transfer system of the current invention pending the proper security measures have been provided.

A description of the architecture of the system of the currently preferred

embodiment will now be provided. The basic architecture of the networks encompassed by IDAS is illustrated schematically in Figure 1. The system can be generally divided into three groups of resources that are generally formed as networks of computers. These networks may include any combination of clients and servers.

Network **102** generally represents a wide area network. In the currently preferred embodiment external network **102** is substantially formed by the Internet and uses the communications protocols of the Internet including the Internet suite of communications protocols (TCP/IP, SSL, etc.). Network **102** further comprises resources that are external to any medical institution, clinic or practitioner's office that are elements of IDAS such that they are visible to multiple institutions.

Networks **104.1** and **104.2** generally represent networks within entities such as hospitals, radiology or other imaging clinics and or government agencies and will be referred to as institutional networks. It will be apparent to one skilled in the art that the above list of institutions containing such networks is not necessarily complete but rather exemplary of the organizations that may contain clients requesting DICOM medical images and DICOM Nodes that may provide medical images to IDAS.

Networks **106.1** and **106.2**, which will be referred to as clinic networks, generally represent entities such as a sole practitioner's office or a small clinic that will request and supply medical images to IDAS. These entities may comprise either a single computer or a small network of computers that may include personal computers that are connected to a server. The number of resources in either networks **106.1** or **106.2** is generally smaller than that contained in institutional network **104.1** or **104.2**.

Networks **104** and **106** are generally local networks which form Local Area Networks (LANs) and are generally found in institutions or clinics, respectively, that comprise a plurality of clients and servers that request and provide medical images, respectively. Networks **104** and **106** are connected to the Internet through any appropriate connection. Internet connections envisioned by the current invention include, but are not limited to wireline phone services, including ISDN and DSL, cable services or wireless services. Each of the above networks that are elements of IDAS will now be discussed in greater detail.

Details of the above three networks are presented in Figure 2. For purposes of presenting the currently preferred embodiment the medical image transfer system will comprise one institutional network **204** and one clinic network **206**. In the currently

preferred embodiment institutional network **204** comprises three basic elements or groups of resources. Client computers **208.1** and **208.2** are local 'stations' within institutional network **204** from which clients can view medical images **220.1** and **220.2** that are stored in archives (image storage servers) **212.1** and **212.2**, respectively. Clients can view medical images from the same local network of which they are a member or request medical images from other local area networks through network **202**. Archives **212.1** and **212.2** are servers that provide medical image storage capabilities for institutional network **204** in which they are located. Archives **212.1** and **212.2** form DICOM Nodes within institutional network **204**. In the currently preferred embodiment archives **212.1** and **212.2** are servers which are capable of storing large quantities of data as is generally associated with medical images. Such servers and the capabilities required of them would be known to those of skill in the art.

Local area network server **210** of institutional network **204** is designated as its "IDAS Node". IDAS Node **210** is also known as a DICOM proxy node. An IDAS Node is a server within a local area network such as institutional network **204** that manages a cluster of DICOM archives (Nodes) **212.1** and **212.2** and serves as the interface between institutional network **204** and network **202**. IDAS Node **210** appears as a regular DICOM Node to the other elements of institutional network **204** and as a proxy server and firewall to external network **202** used to transfer medical images between local networks. IDAS Node **210** further maintains a local list of all DICOM Nodes within the institutional network of which it is a member. Each IDAS Node **210** is responsible for periodically querying each local DICOM archive, **212.1** and **212.2**, to establish a list of all medical images currently located on DICOM Nodes of institutional network **204** of which it is an element.

Network **202** is substantially formed by a wide area network to which networks **204** and **206** are connected and in communications with. In the currently preferred embodiment this wide area network is the Internet. The wide area network of the currently preferred embodiment contains two types of communications links. Links **205** are high bandwidth links that are used for communication of medical images amongst IDAS Nodes. Links **203** are low bandwidth links that are used for communication of control data between IDAS Nodes and list server **214**, which is also

comprised by network **202**. Network **202** also comprises list server **214** that will be referred to as the IDAS Directory.

Communications link **203** provides low bandwidth communications between IDAS Nodes **210** and **216**, and IDAS Directory **214**. Communications link **203** will therefore be used for low bandwidth communications including medical image location and bibliographic information. Communications link **205** provides for high bandwidth communications amongst IDAS Nodes **210** and **216**. In the currently preferred embodiment link **205** is a dedicated high-speed link to the Internet "backbone". Communications link **205** would therefore be used for the transfer of medical images between IDAS Nodes **210** and **216**. Communications link **205** may comprise other communications links that are suited to high bandwidth communications such as ISDN and DSL. Communications links **203** and **205** will both be elements of the Internet. The current invention encompasses any suitable communications link as would be apparent to one skilled in the art.

IDAS Directory **214** acts as a centralized resource for the IDAS Nodes and facilitates the transferring of DICOM compliant medical images across the Internet. IDAS Directory **214** comprises a central list of medical images contained within the networks of IDAS. This list is updated by the IDAS Nodes with information they obtain during the periodic querying of DICOM Nodes.

IDAS Directory **214** further comprises a database containing information on each medical imaging study contained within DICOM Nodes of institutional network **204** and clinic network **206** and each IDAS Node of the medical image transfer system of the current invention. The medical imaging study information comprises unique identifiers (referred to as "Study Instance UIDs" in DICOM) of patient studies managed by the IDAS Nodes in institutional and clinic networks, **204** and **206**, respectively. IDAS Directory **214** further comprises contact information for each IDAS Node - namely for each patient study accessible through IDAS there is a reference to the IDAS Node from which the study can be retrieved (e.g., the network address and the DICOM Application Entity Title of that node). In the currently preferred embodiment where the wide area network to which the all IDAS Nodes are connected is the Internet, contact information may also comprise a Universal Resource Locator (URL) of each of the IDAS Nodes. IDAS Directory **214** contains access control information for each patient study listed within it to ensure that only the

authorized users have access to a a given patient study. This information comprises; client name, client group name (multiple clients assigned a single security token), IDAS Node name and IDAS Node group name (multiple IDAS Nodes assigned a single security token). IDAS Directory **214** is a single entity at the logical level but it is implemented as a distributed architecture similar to DNS of the Internet. Therefore, IDAS Directory **214** acts as a distributed repository of information about all IDAS Nodes connected to and in communication with the system of the current invention. It further acts as a distributed repository containing information about all medical images managed by all IDAS Nodes.

Clinic network **206** generally represents local area networks of individual users or small clinics. In the currently preferred embodiment network **206** comprises computer **216**, that forms an IDAS Node and client computer **218**. Clinic network **206** may be distributed, where central IDAS Node **216** may be a regional node to which a plurality of remote clients **218** are connected and in communication with. Such a regional IDAS Node would be maintained by an IDAS administrator. In an alternative embodiment clinic network **206** may only comprise a single computer in a clinic or practitioner's office which would act as both the IDAS Node and viewer of clinic network **206**. While the communication between IDAS Nodes may use DICOM the currently preferred embodiment uses proprietary protocols that are optimized for the transfer of data on the Internet. Communication between IDAS Nodes and the IDAS Directory uses standard DICOM.

Communication of medical images between IDAS Node **210** and clients **208.1** and **208.2** and between IDAS Node **210** and image storage servers **212.1** and **212.2** of a given institutional network **204** may be conducted using standard DICOM protocols and links that are common to such networks as would be apparent to those of skill in the art. Similarly the transfer of medical images between IDAS Node **216** and client **218** of network **206** uses standard DICOM. Further communication with third-party software is also conducted using standard DICOM protocols. In the currently preferred embodiment communication between IDAS Nodes of different networks across external network **202** uses proprietary protocols that are highly optimized for medical image transfer via the Internet while maintaining DICOM information. Furthermore, the proprietary protocol may support additional value-enhancing services, such as e-conferencing or consultation, expert referral directory, emergency

over-read service, or even a Computer-Aided Diagnosis (CAD) service that marks suspected lesions on the overlay of medical images as they pass through the system.

Thus system of the currently preferred embodiment uses standard DICOM protocols for the transfer of medical images within an institutional network and translates the medical images into a proprietary format for communications between IDAS Nodes i.e. across the Internet.

The methods associated with the transferring of medical images using IDAS will now be considered. The first stage of the process of transferring medical images using IDAS is the formation of a query and execution of security protocols. This stage of medical image transfer is shown in the flow chart presented in Figure 3. A client wishing access to DICOM medical images contained in a DICOM Node that is an element of the IDAS system of the current invention and is outside of the network of which the client is an element sends a single regular DICOM query at step **330** to IDAS Node **210** or **216** of institutional network **204** or clinic network **206**, respectively, with which the client is associated. This query contains client information including; client name, client group and a password that will determine the extent of authorized access within IDAS for the requesting client. The supplied client information is analyzed at step **332** by the IDAS Node with which the client is associated to determine if additional information is required. Each IDAS Node will have current access requirements that are in agreement with other IDAS Nodes of the system. If additional client information is required the client will be prompted at step **334** for the additional information. This additional information is then analyzed to determine the scope of authorized access for the requesting client. When sufficient information has been provided for determination of a given client's access the IDAS Node with which the requesting client is associated contacts IDAS Directory **214** at step **336**. IDAS Directory **214** establishes a list at step **338** of available studies that match the request and are within the client's scope of access, based on the client's identification information. This list is returned to the client at step **340** via the IDAS Node with which the client is associated as part of the standard DICOM Query/Retrieve protocol. The currently preferred embodiment, through the use of central IDAS Directory **214**, allows file transfer across an external network without the manual addition of DICOM IP address and port number to contact lists. Further, only a single query need be sent from the IDAS Node associated with requesting client

to IDAS Directory **214**.

A flow chart of the medical image retrieval process is presented in Figure 4. The requesting client selects a study or medical images that they would like to retrieve from the list of appropriate available studies returned at step **340**, at step **450**. The IDAS Node with which the requesting client is associated then interacts with IDAS Directory **214** at step **452** and obtains the contact information of the image storage server's proxy IDAS Node(s) at step **454**. IDAS Directory **214** also returns a security code at step **454** that will allow the IDAS Node with which the client is associated to request the selected study from the IDAS Node of the local area network that comprises the selected study. The IDAS Node with which the client is associated accesses the image storage server's (DICOM Node comprising the requested medical images) proxy Node at step **456** at which time study retrieval is initiated. The server proxy Node retrieves the requested study or medical image data from the image storage server containing the requested data using standard DICOM at step **458**. The retrieved study or medical image data is then forwarded to the requesting client's proxy (IDAS) Node at step **460** via the Internet using a proprietary image storage protocol. The IDAS Node then relays the medical images to the client's viewer using standard DICOM.

Prior to delivery of an image to a requesting client i.e. after step **460**, IDAS determines what, if any, patient information should be obscured from the requesting client. In the currently preferred embodiment there are two levels of access a client may have with respect to patient information comprised by the medical images. In one level of access the client may have so called 'full' access where all study and patient information is presented to the requesting client. In another level of access specific patient information is obscured from the medical image and or associated study record before presentation to the requesting client. Information including, but not necessarily limited to, patient name, patient address and referring physician is obscured from the medical image prior to delivery to the requesting client in this level of access. The process of obscuring information is performed by the IDAS Node of the local area network comprising the image storage servers that are providing the medical images. Information related to the level of access of a requesting client is provided by the IDAS Directory to the IDAS Node of the local area network comprising the image storage servers that are providing the medical images.

It is envisioned that alternative embodiments of the invention may provide different levels of access with respect to patient information comprised by the medical images. In another level of access any information that would disclose a patient's identity may be removed. Other levels of patient information may be a function of clients use of the medical images and any applicable laws in either the jurisdiction of origin for the medical images or the jurisdiction of the requesting client. These and other alternative embodiments are encompassed by the current invention.

The currently preferred embodiment was described with reference to a specific number of clinic and institutional networks that each had particular number and configuration of computers and/or other elements. It will be apparent to one skilled in the art that the exact number of clinic and institutional networks can be varied within the scope of the current invention. Further, the configuration of client viewers and archive servers can be varied within a given network and still lie within the scope of the current invention.

In an alternative embodiment the medical images may be stored accordingly to protocols other than DICOM. Such protocols will be apparent to those of skill in the art.

In another alternative embodiment the wide area network used in the transfer of medical images may be formed by a network other then the Internet. Such wide area networks and their use will be apparent to those of skill in the art.

While the invention has been described according to what is presently considered to be the most practical and preferred embodiments, it must be understood that the invention is not limited to the disclosed embodiments. Those ordinarily skilled in the art will understand that various modifications and equivalent structures and functions may be made without departing from the spirit and scope of the invention as defined in the claims. Therefore, the invention as defined in the claims must be accorded the broadest possible interpretation so as to encompass all such modifications and equivalent structures and functions.

What is claimed is:

1. A system for transferring one or more medical images between two or more local area networks across a wide area network, the system comprising:

one or more image storage servers, each image storage server providing one or more medical images that conform to a common image storage and retrieval protocol, each image storage server being an element of a local area network and each image storage server being connectable to a wide area network;

a list server for providing a list of one or more medical images available from the image storage servers and contact information for each local area network, the list server being connectable to the wide area network; and

one or more client computers being able to request one or more medical images for transfer across the wide area network using the common image storage and retrieval protocol, each client computer being an element of a local area network and each client computer being connectable to a wide area network.

2. A system according to claim 1 wherein each local area network comprises a local area network server, each local area network server being connectable to the wide area network and providing an interface between the local area network within which it is comprised and the wide area network.

3. A system according to claim 1 wherein the common image storage and retrieval protocol is the DICOM protocol.

4. A system according to claim 1 wherein the wide area network is the Internet.

5. A system according to claim 4 wherein the wide area network comprises dedicated communications links that facilitate the transmission of digital image information.

6. A system for transferring medical images over a wide area network, the system comprising:

two or more local area networks, each local area network comprising a collection of one or more medical images, the on or more medical images being

comprised by one or more image storage servers and the one or more medical images conform to a common image storage and retrieval protocol, one or more clients being able to request one or more medical images and a local area network server being connectable to the wide area network; and

a list server for providing a list of one or more medical images available from the image storage servers and contact information for the local area network servers, the list server being connectable to the wide area network.

7. A system according to claim 6 wherein the common image storage and retrieval protocol is the DICOM protocol.

8. A system according to claim 6 wherein the wide area network is the Internet.

9. A system according to claim 8 wherein the wide area network comprises dedicated communications links that facilitate the transmission of digital image information amongst the local area networks.

10. A local area network that forms an element of a system for transferring one or more medical images over a wide area network, the local area network comprising:

one or more computers acting as clients within the local area network;

one or more image storage servers comprising the one or more medical images that conform to a common image storage and retrieval protocol; and

a local area network server, the local area network server providing an interface between the local area network and a wide area network to which the local area network server is connected to and in communications with, the local area network server maintaining a list of image storage servers within the local area network containing medical images.

11. A local area network according to claim 10 wherein the common image storage and retrieval protocol is the DICOM protocol.

12. A local area network according to claim 10 wherein the local area network is an element of an institution.

13. A local area network according to claim 10 wherein the local area network is an element of a clinic.

14. A local area network according to claim 10 wherein the local area network is an element of a medical practitioner's office.

15. A local area network according to claim 10 wherein the local area network server converts the common image storage and retrieval protocol to a protocol appropriate for transmission of the medical image across the wide area network.

16. A local area network according to claim 10 wherein the local area network server periodically queries the image storage servers to determine the images contained therein.

17. A list server that is an element of a system for transferring one or more medical images across a wide area network, the list server comprising:

a list of one or more medical images comprised by one or more image storage servers of local area networks that are elements of a system for transferring medical images;

a directory comprising contact information for multiple local area network servers of local area networks that are elements of a system for transferring medical images; and

a connecting unit for connecting to the wide area network for communicating with the two or more local area network servers.

18. A list server according to claim 17 further comprising security information related to clients that are elements of the system for transferring medical images, the security information to be used to determine the medical images that are available to the client for transferring.

19. A list server according to claim 17 wherein the contact information comprises universal resource locators for the local area network server of a local area network.

20. A list server according to claim 17 wherein the security information comprises at least one of: client name, client group name, local area network server name and local area network server group name.

21. A method of requesting one or more medical images that conform to a common image storage and retrieval protocol within a system for transferring one or more medical images across a wide area network, the method comprising the steps of:

receiving a query by a local area network server from a requesting client who is an element of the same local area network as the local area network server, the query being in accordance with a common image storage and retrieval protocol;

analyzing information provided in the query by the local area network server of the local area network of the requesting client;

contacting a list server by the local area network server of the local area network of the requesting client;

receiving from the list server a list of one or more medical images comprised by the system for transferring medical images which are available to and are of interest to the requesting client; and

returning the list of available medical images to the requesting client.

22. A method according to claim 21 wherein the information provided in the query comprises at least on of; client name, client group and a password.

23. A method according to claim 21 wherein the common image storage and retrieval protocol is the DICOM protocol.

24. A method of transferring one or more medical images that conform to a common image storage and retrieval protocol from a first local area network that comprises one or more medical images and a local area network server to a second local area network that comprises one or more clients and a local area network server across a wide area network, the method of transferring one or more medical images comprises the steps of:

receiving a selection of a one or more medical images which conforms to the

common image storage and retrieval protocol;

contacting a list server of the wide area network by the local area network server of the second local area network;

providing contact and security information by the list server of the wide area network to the local area network server of the second local area network;

contacting the local area network server of the first local area network by the local area network server of the second local area network using the contact and security information;

retrieving the requested one or more medical images by the local area network server of the first local area network; and

forwarding of the one or more medical images retrieved from the first local area network to the second local area network via the external network.

25. A method according to claim 24 wherein the external network is the Internet.

26. A method according to claim 24 wherein the common image storage and retrieval protocol is the DICOM protocol.

27. A method according to claim 24 wherein patient information comprised by the one or more medical images is presented to the requesting client.

28. A method according to claim 24 wherein patient information comprised by the one or more medical images, including at least one of patient name, patient address and referring physician, is obscured from the one or more medical image prior to their receipt by the requesting client.

29. A method by which a list server facilitates the transfer of one or more medical images across a wide area network, the method comprising the steps of:

receiving a query from a local area network server of a client requesting one or more medical images;

forming a list of one or more medical images comprised by the system for transferring medical images;

returning the list of one or more medical images to the local area network

server of the local area network that comprises the client requesting the one or more medical images; and

providing contact and security information to the local area network server of the local area network that comprises the client requesting one or more medical images.

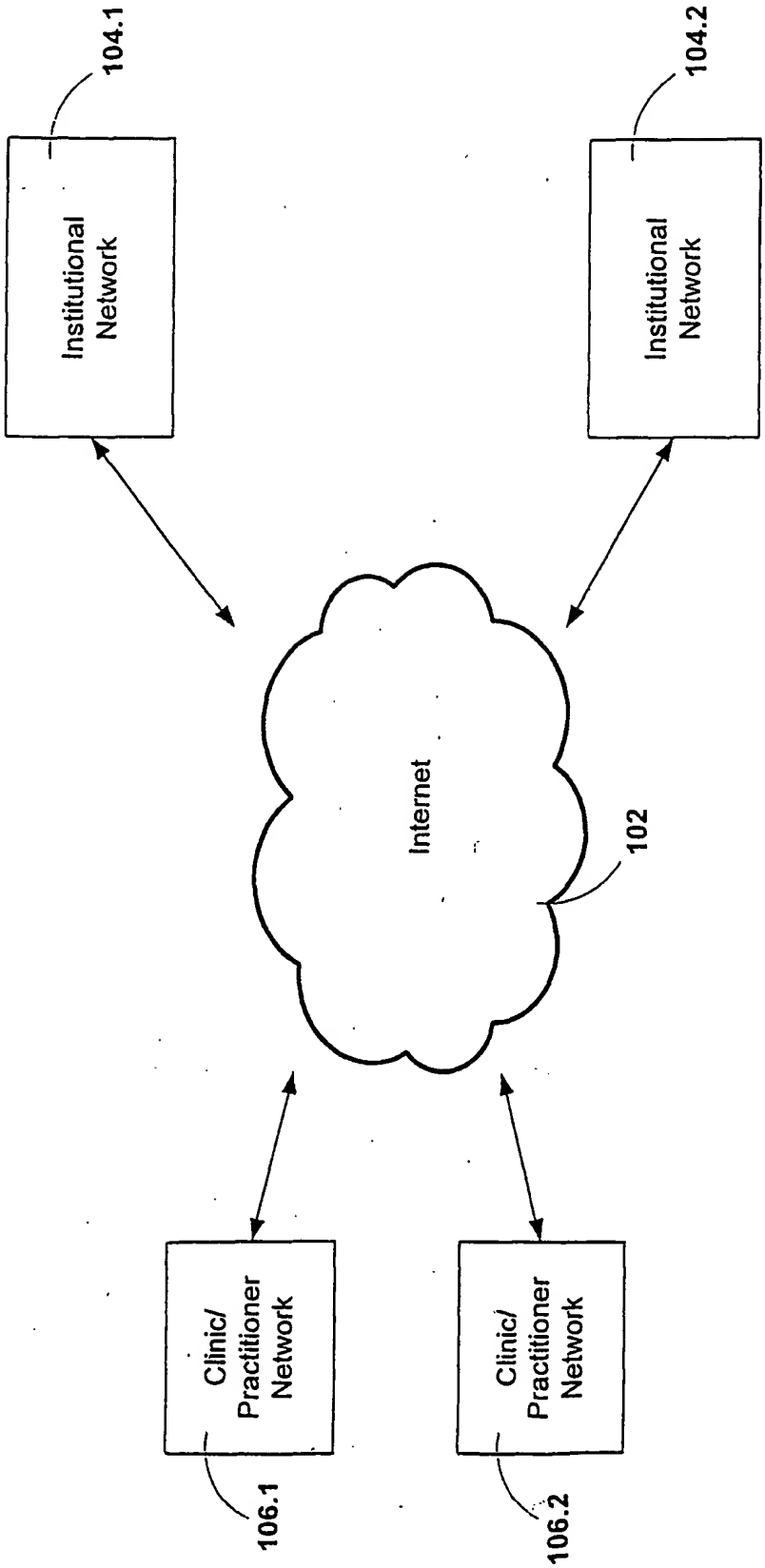
104.1
104.2
Institutional Network
Institutional Network
Internet
102
Clinic/ Practitioner Network
Clinic/ Practitioner Network
106.1
106.2

Figure 1

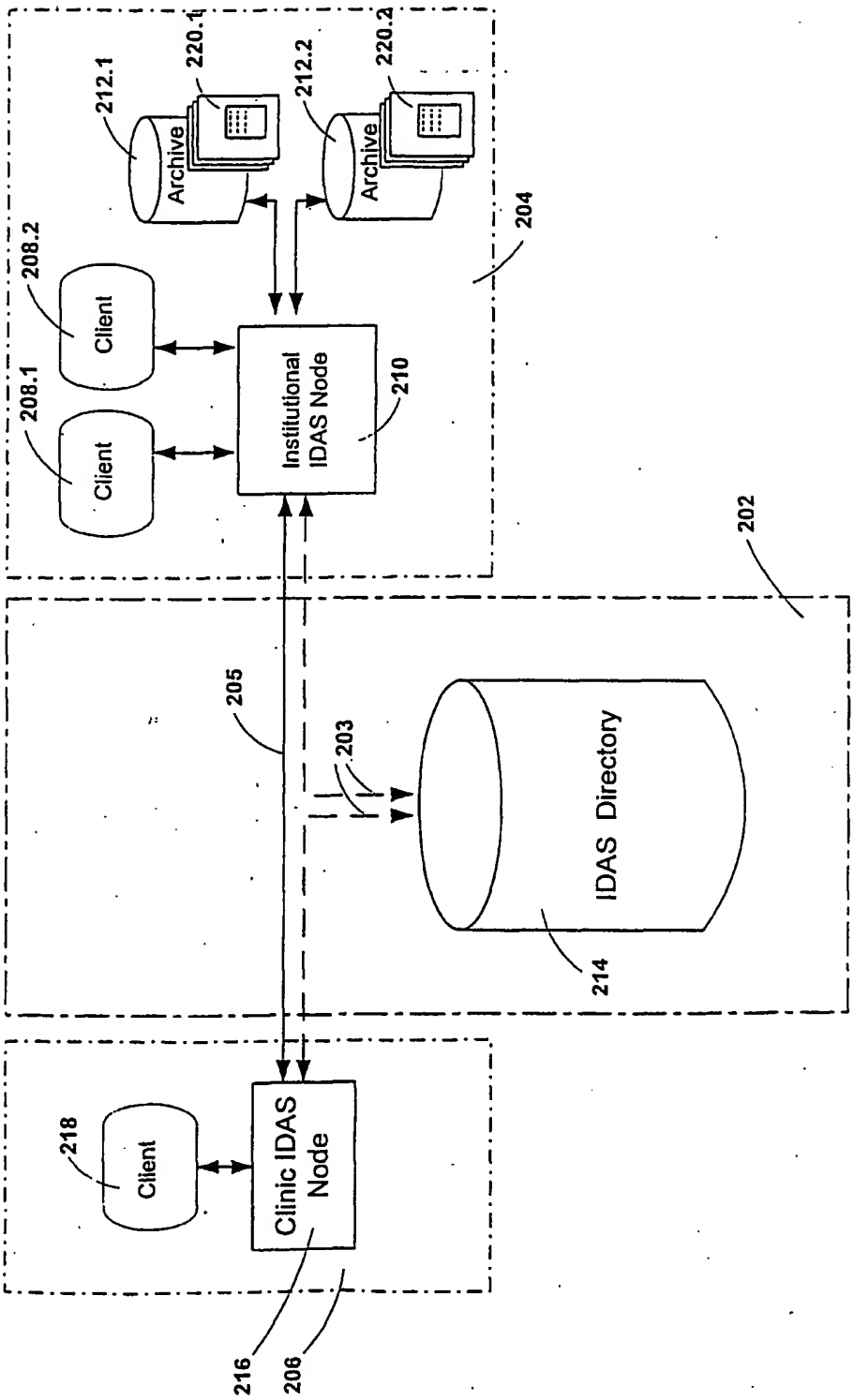
212.1
220.1
212.2
220.2
Archive
Archive
204
208.2
Client
208.1
Client
Institutional IDAS Node
210
202
205
203
IDAS Directory
214
218
Client
Clinic IDAS Node
216
206

Figure 2

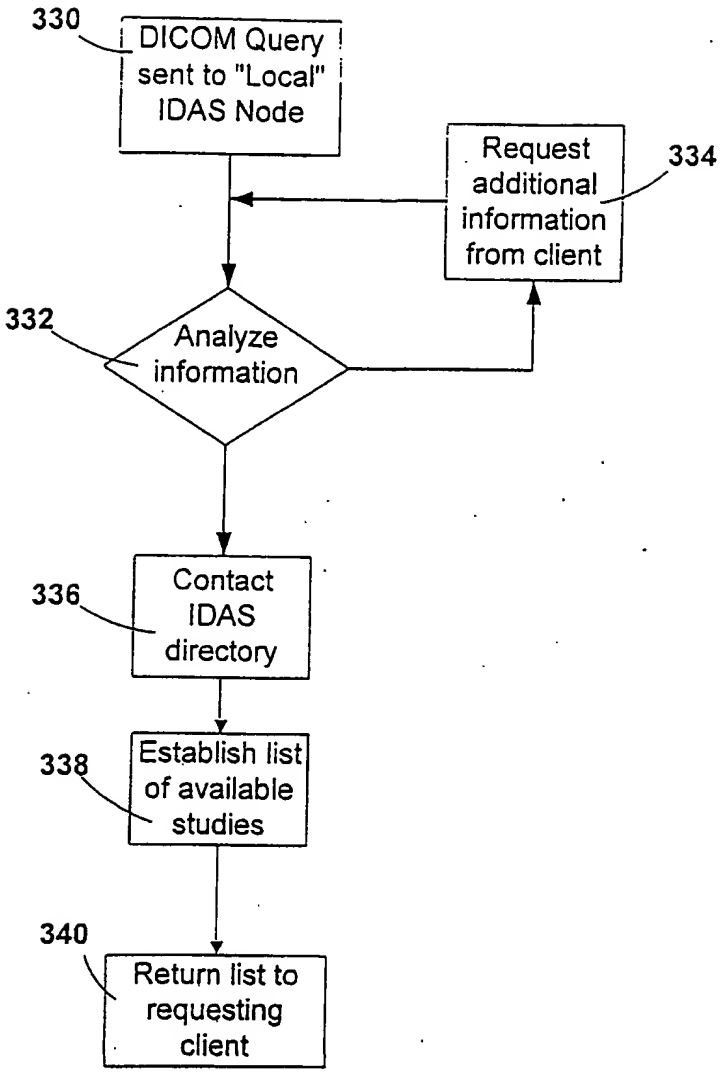
330
DICOM Query sent to "Local" IDAS Node
Request additional information from client
334
332
Analyze information
336
Contact IDAS directory
338
Establish list of available studies
340
Return list to requesting client

Figure 3

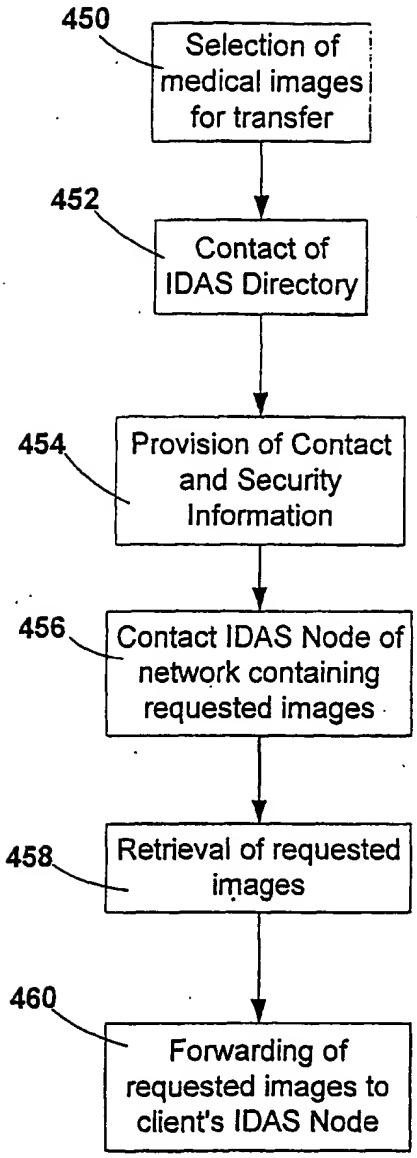
450
Selection of medical images for transfer
452
Contact of IDAS Directory
454
Provision of Contact and Security Information
456
Contact IDAS Node of network containing requested images
458
Retrieval of requested images
460
Forwarding of requested images to client's IDAS Node

Figure 4